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ABSTRACT

Minimal class participation by students with limited English proficiency (LEP), and LEP student failure to pass regular classroom tests were addressed through cooperative learning in a second grade science class. Classroom techniques used included strategies for using the scientific method of investigation, hands-on activities, experiments, music, creative movement done to poetry, and a science fair exhibit. Each LEP student was grouped with at least two bilingual students who spoke both Spanish, the target language group, and English. Provisions were made with bilingual teachers for assessment of those unable to be tested in English. Results indicate that a comprehensive program using bilingual, cooperative learning and active involvement of all students in a wide range of instructional activities will better meet the needs of students with limited English proficiency. (Author/MSE)

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TEACHING SCIENCE TO STUDENTS WITH LIMITED ENGLISH PROFICIENCY USING COOPERATIVE LEARNING TECHNIQUES

by

Ellen H. LeDuc

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A Practicum Report

Submitted to the Faculty of the Center for the Advancement of Education at Nova University in partial fulfillment of requirements for the degree of Master of Science.

The abstract of this report may be placed in a National Database System for reference.

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Authorship Statement:

I hereby testify that this paper and the work it reports are entirely my own. When it has been necessary to draw from the work of others, published or unpublished, I have acknowledged such work in accordance with accepted scholarly and editorial practice. I have this testimony freely, out of respect for the scholarship of other workers in the field and in the hope that my own work, represented here, will earn similar respect.

Signed: Ellen H. LeDuc
Ellen H. LeDuc

Abstract

Teaching Science to Students with Limited English Proficiency Using Cooperative Learning Techniques. LeDuc, Ellen H. 1990: Practicum Report, Nova University, The Center for the Advancement of Education. Descriptors: Elementary Science/ Limited English Proficiency/ Bilingual Science/ Cooperative Learning/ Hands On Science/ Scientific Method in Primary Grades/ Preparation of Science Fair Exhibit/

Minimal class participation by students with limited English proficiency and failure of the students with limited English proficiency to pass tests given in the regular classroom were addressed by the implementation of a science program involving strategies for the use of the scientific method of investigation, hands on activities, experiments, music, creative movements done to poetry, and a science fair exhibit. Cooperative learning strategies were employed, utilizing the bilingual setting to the extent that each student with limited English proficiency was paired with at least two bilingual students who spoke both Spanish, the language of the target group, and English. Special provisions were made with bilingual teachers for assessment of those students who were unable to be tested in English. The results indicated that a comprehensive program utilizing bilingual cooperative learning paired with active involvement of all students in a wide range of instructional strategies will better meet the needs of students with limited English proficiency.

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CHAPTER I

Purpose

This practicum took place in the suburbs of a large metropolitan area in the southern part of the United States. The school was located within a single-family home residential area where houses were approximately 20 years old, and had few young children in residence. The greatest number of students came from apartments and condominiums that lined major avenues and streets in the area. Of the 28 students in the second-grade class under observation, 18 students lived in rental apartments.

The enrollment at this school consisted of 1,108 students. An ethnic breakdown showed 40.4 percent white, 7.9 percent black, 49 percent Hispanic, and 2.7 percent Asians. There were no Native Americans enrolled at that time. Of these figures, 52.5 percent of the students were male, and 47.5 percent were female. Classes included kindergarten through sixth grade.

The school staff consisted of one principal and one assistant principal. Five clerical/secretarial staff members worked in the school office. There were 37 regular classroom teachers whose students benefitted from

the specialized expertise of 1.5 art teachers, two physical education teachers, 1.5 music teachers, three exceptional education teachers, and a speech teacher who was assigned as a half-time employee of this school.

The bilingual program utilized 2.5 teachers with the goal of teaching Spanish. One of these faculty members taught Spanish as a second language and 1.5 units were allocated for the teaching of Spanish to speakers of Spanish. To augment the program for students with limited English proficiency, one teacher worked full-time teaching the curriculum content in the home language (Spanish). In addition, there were Japanese, Korean, and Chinese language specialists who visited the school on a twice-weekly basis to aid those students for whom there was need for supplemental instruction in the home language, but the enrollment was not sufficient to employ a full- or half-time instructor. To complete the bilingual program, 1.5 teaching units were used for the teaching of English as a second language.

One counselor had the job of working with individuals, groups, and teachers. This person was also in charge of all referrals for testing and conducted the child study team meetings and staffing meetings. A

psychologist worked closely with the counselor, but was in the building only one day each week. Primary duties of the psychologist were testing and prescribing the best program for children who were having difficulty learning up to their potential in the regular classroom.

One media specialist and one library aide managed the media center and taught classes in the use of the facilities.

Other aides included: 1) Four for compensatory education, whose duties included working with students in grades two through six with stanines 1 or 2 on a pull-out basis during the regular school day. 2) One career education aide who met with every class each week for a 30-minute class time during which students were made aware of different jobs and careers available and the kinds of work done in each of these occupations. 3) One systems aide who was installing reading systems and math systems on the computer to facilitate record keeping in this area. Three classroom aides were assigned to learning centers where the student count was high and teachers needed the support afforded by these employees.

Four custodians divided the work of keeping the school clean. Two worked during the day, and two came

on duty after the students left in the afternoon and remained until the eight-hour shift ended at 11:00 p.m.

The food was not cooked at the school cafeteria, but at a neighboring high school. It was the responsibility of the cafeteria manager to transport the meals to the target school. She was assisted in final preparation and serving by three other staff members. The cafeteria was monitored by two aides during the three hour serving time when students were at lunch.

The attitude of the community toward the school appeared to be positive, based on a questionnaire sent to all parents. Strengths cited by parents included:

> Good relationships between parents and staff, professionalism of teachers, friendly environment, attention toward students, at-home feeling for children, and an administration in touch with current educational issues.

Another feature of the school that was appreciated by many parents was the extended-day care offered in the Before-and After-School-Care Programs.

Important goals for the school, based on responses of parents, included: "Higher academic standards, increased use of computers, emphasis on physical fitness, a more comprehensive sports program, and continued stress of an emotionally positive environment for children."

The Parent-Teacher Association was strong and active. Great effort was spent on money-making projects to benefit the students. In addition to purchases, the parents enhanced the school program through their services on a volunteer basis throughout the year.

The staff of the school was concerned with maintaining a safe, orderly learning environment. Each teacher had been trained in and implemented Assertive Discipline procedures. Additionally, steps were made to improve student attitude toward school by implementing special tutorial programs or special interest groups before school. A mentor program was planned whereby volunteer teachers would be matched, on an individual basis, with those students who had been identified by individual teachers and the counselor as "at risk."

The teacher who is writing this paper has taught in the subject school for seven years and has been responsible for first, second, or third grade classes during that time. The implementation of this practicum took place in the spring of 1990.

The classroom where this practicum was conducted was in a learning center with two additional second-grade classes. A total of 86 students and three teachers

shared the space in one large classroom. At the beginning of the year, students were given placement tests in reading and math, records of past experience were examined, and recommendations made by the first grade teachers were considered. The students were then divided into three groups with similar abilities for math and language arts only.

The content subjects were taught by the homeroom teacher or by the team of teachers in the learning center. Because of scheduling difficulty, the only time when team teaching of content curriculum could take place was during the last 30 minutes of the day. At that time, English for speakers of other languages (ESOL) classes were being held in another room with pull-outs from each of the second grade classes.

Because of this scheduling difficulty, the implementation of the practicum project was conducted during the first half hour of the day on Tuesdays, Thursdays, and for one hour on Friday mornings. At that time, all students in attendance were with the homeroom teacher. The teacher writing this report of the practicum project had no control over the scheduling, but could tailor the content and methods of teaching to the

group being taught as long as county objectives were met and academic learning time was maximized.

This study involved five second grade students with limited English proficiency who were generally cooperative and willing to participate in activities with which they had some confidence. They were not behavior problems. These five students spoke Spanish and were in the English for Speakers of Other Languages class for one hour each day. They were taught mathematics in a bilingual setting.

The target students were either not in an American school during the 1988-89 school year or were unable to take standardized tests because of a lack of proficiency in English; therefore, no scores of this kind were available for use in tracking.

The science portion of the Stanford Achievement Test was not administered at the kindergarten, first or second grade levels. However; low median scores were evident in all other grades. The highest score was attained in third grade with a score of 57 percentile. The lowest score on the Stanford Achievement Test in science was 48 percentile in fourth grade (Appendix A).

It had been noticed that the five students would

look at pictures in the science book, watch as science demonstrations took place, and color pictures if asked to do so. However, when questioned by the teacher writing this practicum report about pictures in the science book (Appendix B), students were unable to demonstrate an understanding of the content. It was also noted that they were not able to understand enough of the language to be aware of the purpose of science activities that occurred in the classroom. (Appendix C)

The chapter test for the first unit in the state adopted Science Series, Journeys in Science, (Appendix D) showed little understanding of the materials covered. The tests given to all students in the class were not even attempted by the target students. Random lines were sometimes drawn or letters were scribbled on the page in a presumed effort to make others think that they were answering questions.

It was not possible to identify the lack of English skills as the only attributing factor to the failure of these students to meet criteria for science. The teacher writing this practicum understood the impact of acculturation (Brown, 1987) that certainly affected these new residents, all of whom lived in another country until

just prior to this study.

A forced-choice questionnaire (Appendix E) based on suggestions by H. Ned Seelye (1984) was prepared with the assistance of a bilingual teacher at the subject school to measure self-esteem of students with limited English proficiency before and after the ten-week period of this study.

The teacher writing this practicum believed that the science program for all students needed to undergo a change to improve skills in the science area of the curriculum. Results are being reported only on the specified group of three girls and two boys who were functioning at ESOL, Level I or II at the time of the implementation.

The program designed by the writer was intended to facilitate the learning of science by a specific group of five students with limited English proficiency. Concurrently, students with limited English proficiency were expected to increase involvement in the activities of the class and expand their English vocabulary. A variety of techniques and activities were utilized in an attempt to fulfill the following objectives by the conclusion of a ten-week implementation time frame.

1. Over a period of ten weeks at least 80 percent of the five students in the target group were to improve their ability to observe and answer questions involving the scientific method of investigation. An improvement in 50 percent of the responses to the questions shown in Appendix G was expected.

2. By the end of ten weeks, at least 80 percent of the five target students were to be able to identify significant vocabulary used in steps of the scientific method of investigation with eighty percent accuracy as measured by a test of terms (Appendix I).

3. Pre- and posttest were to be given to evaluate gains in understanding of science concepts and vocabulary appropriate to second grade. Over the period of ten weeks, at least 80 percent of the five students would improve their knowledge of content. At the end of this period of time, at least 80 percent of the students were to produce correct responses to at least 80 percent of the test questions (Appendix K).

4. Self-esteem tests were to be administered at the beginning of the ten-week period and repeated at the end of the ten-week period. A positive attitudinal change

on ten percent of the questions was expected (Appendix E).

CHAPTER II

Research and Solution Strategy

Piaget theorizes that thinking develops along certain lines. To inspire thinking and learning, teachers should ask questions that stimulate children to observe and pay attention to their own ideas (Gordon and Browne, 1989).

Teachers should be encouraged to:

.Use or create situations that are personally meaningful to children.

.Provide opportunities for them to make decisions.

.Provide opportunities for them to exchange viewpoints with their peers (Williams and Kamii, 1986).

This teacher felt that these goals would be accomplished through the use of scientific experiments conducted in a cooperative learning environment. Projects were chosen that related to science questions the children had expressed. Opportunities to make decisions during the experimentation were provided. In order to work in a cooperative learning environment, it was essential that viewpoints were exchanged with peers.

Anderson (1984) wrote about a study conducted in a small, suburban school district that included all of the

twenty-two teachers, from second through fifth grades that taught science. Observational data was collected by trained observers who noted, every ten minutes, what was happening in the classroom, including organization, instructional materials being used, noise level of the classroom, location and activity of the teacher and the activity of each student. Kinds of questions presented by the teacher, and amount of time spent in investigative activities were recorded.

The results indicated that most of the students' time was spent listening to the teacher or to other students. Students spent a significant amount of time in off task activities such as "doing nothing" and social talk. It was explained that this was not chaotic, but that students waited to have papers passed out, waited to sharpen pencils, waited for teachers to answer questions, and waited after finishing one activity before moving on to another. In twenty-five percent of the classes, manipulatives were used, but only six percent of the student time was spent using these manipulatives.

The results of the study show that teachers were most comfortable using whole-class discussions as a method of teaching with occasional demonstrations or

hands-on activities. For these teachers, manipulative science materials were associated with uncertainty and loss of control. Anderson points out the conflict many teachers feel between engaging in practices advocated by science educators and their own need for simplicity and control. To avoid this conflict, the teacher implementing this practicum carefully planned for activities, including making materials available, stating clear concise goals, and organizing peer groups in a structured manner.

An investigation was conducted by Rodriguez (1984) to determine the effectiveness of an inquiry approach to science and language teaching to further develop classification and oral communication skills of Mexican-American third-grade children. A control group and an experimental group were pretested using one instrument that measured the ability to communicate orally and one that was designed to measure the child's ability to classify concrete objects. At the conclusion of the study all 64 students were posttested using the same instruments.

Significant differences were found between the experimental and the control group. The inquiry science

lessons had an overall positive effect on the oral communication and classification skills of Mexican-American bilingual children. Rodriguez assumed that both classification and oral communication skills could be developed using the science inquiry method with emphasis on concrete experiences.

D. Ridolf (1980), in the publication, "Something that Works for Me..." advocates the involvement of all five senses when teaching a unit on science. Ridolf's work was done with children with learning disabilities. Students who increased the number of senses used in investigation gained faster than those who only observed. [Note: It may not always be possible to use all five senses, but maximum involvement of as many senses as possible was advocated.]

A collection of works edited by Crandall (1987) includes a study by Carolyn Kessler and Mary Ellen Quinn. Kessler, a teacher in rural Texas, used a lab-based inquiry approach to science that emphasized the "how" of science. Using the inquiry-based, problem-solving orientation, students learn to define a science problem, state a hypothesis, gather and analyze data, and make statements relating the hypothesis to the data. In the

one-year investigative period, the class made an average gain of more than three years in reading levels and developed considerable enthusiasm for writing in English, their second language.

Not only does the manipulative aspect of inquiry-based science seem to make a difference in the progress of students, cooperative interaction between peers is cited as having a positive influence on learning. As Slavin (1983) indicates,

> More than 50 field experiments of four to thirty weeks' duration have established that when students work in four-member groups and are rewarded based on the learning of all group members, they achieve consistently more than do students who are in traditionally taught classes.

Further research was attempted by Stevens and his colleagues (1987) to establish the effects of cooperative learning on the teaching of reading and language arts in the elementary schools. Eleven experimental classes and ten control classes were observed over a twelve-week period.

The control group used traditional methods and curriculum materials. The basal reader, three reading groups, with workbooks and worksheet activities for follow-up time was the usual content for the reading.

Whole class instruction was typical for the language arts program.

The experimental group teachers were trained in Cooperative Integrated Reading and Composition (CIRC). In this approach, students worked in heterogeneous learning teams for all reading, language arts, and writing activities. In reading, students worked with partners during follow-up times on partner reading, decoding, story structure, prediction, and story summary activities related to the basal stories. In writing and language arts, students used a process approach to writing, with peer conferences during planning, revising, and editing stages of the process. Language instruction was followed by team practice in mechanics and expression activities.

Statistically significant differences favoring the experimental group were found on reading comprehension, reading vocabulary, language expression and spelling tests used to evaluate the CIRC program and the control group. Those students in the CIRC program also showed greater gains when writing samples and oral reading were measured.

A second study by Kessler and Quinn was an extension

and replication of the first. The duration was 24 weeks, as opposed to 12, and involved a wider range of ethnic and socio-economic backgrounds. Similar results were found when the posttests were administered.

Kessler notes that when "...state-of-the-art principles of classroom organization, motivation, and instruction are used in the context of a cooperative learning program, student achievement in reading and writing can be increased."

DeAvila (1981) describes a program to improve the intellectual, academic and linguistic functioning of children in a linguistically and culturally mixed setting with nine classrooms participating. Children were given the opportunity to engage in approximately 100 math/science activities and experiments. Students worked independently or in small groups where cooperation and verbal interaction were essential.

Subjects of the study were 253 students in second third and fourth grades. Participation continued for 10 to 12 weeks. Although significant variations between schools were observed, it was difficult to determine gains in thinking skills. However, style and approach to problem solving seemed to improve.

In a more recent article, Slavin (1987) points out that research consistently indicates that cooperative learning benefits all students. He discloses that of more than 30 studies conducted in urban, rural, and suburban schools across the United States, 82 percent found that students in Student Team Learning classes gained more in achievement than did students in traditionally taught classes working on the same objectives. Slavin also reports significant gains in student self-esteem, liking of class, attendance, and behavior.

The teacher writing this practicum project used hands-on science in a cooperative learning situation to involve all students in the science program. Hands-on discovery was an important part of the science program. The ability to discover does not depend upon verbalization, but allows higher order thinking and reasoning in any language.

Students with limited English proficiency were the target group for this practicum. Interaction with students who were bilingual in English and Spanish helped those students to put thinking, reasoning, and discovery into words, and in many cases, to be able to understand

the scientific concepts in the English language. Choral reading, singing, and art activities provided students with an opportunity for self-expression in a non-threatening and fun way.

CHAPTER III

Method

Methods used by the implementor of this practicum covered a wide variety of instructional strategies designed to improve the science program for students with limited English proficiency.

Target students had been identified by the staff of teachers in the English for Speakers of other Languages program (ESOL) at the time of their enrollment as candidates for the program. Tests of oral language proficiency assessed receptive (listening, reading) and productive (speaking, writing) skills. It was found that the target students, upon entry into the program, were either functioning at Level I (Nonindependent) or Level II (Intermediate A).

Week One:

A meeting was held with the principal to discuss the proposed timetable. Instructional objectives and forms for evaluation were addressed at that time. Permission was granted for implementation of the proposed program.

Coordination was begun with the bilingual teacher who had volunteered to assist with language difficulties

as they arose. Each student with limited English proficiency was introduced to the bilingual teacher. A comfortable rapport was established between teacher and students.

A self-esteem questionnaire was administered (Appendix E). Most of the children exhibited a positive attitude toward themselves and school (Appendix F). The students were interviewed and encouraged to express themselves openly about their attitudes. One child indicated a dislike for the Spanish language. When questioned, it was discovered that the desire to forget the past and move into the society in which the student was living was important. The teachers in the native country had mistreated this child and a brother to the extent that there are scars on the brother as a result of such beatings. Although this was a motivational factor for the learning of English, a rejection of a language was not encouraged. It was hoped that the respect shown for Spanish language in the classroom would influence an attitudinal change in the child.

The teacher who is writing this practicum divided the students into five cooperative learning groups and provided practice time for learning cooperative methods

of operation within the group.

A pretest of science concepts and vocabulary was administered (Appendices I and K). The test included in Appendix I showed the ability of the student to match scientific terms to their corresponding positions on a science fair board. These terms identify the steps of the scientific method used by second grade students. The test found in Appendix K assesses science concepts that were considered important for meeting instructional objectives for second grade. The results were charted for comparison to posttest scores (Appendix L).

Week Two:

The first experiment involved the effects of temperature on the evaporation of water. The organization of an experiment was presented. Students observed and documented the experiment under the careful direction of the teacher.

Interaction among group members insured that all members of the set were able to describe and record the procedure for completing the experiment using the scientific method.

An evaluation form (Appendix G) was completed by all participants. Those target students who were unable to

complete the form in English were interviewed by the bilingual teacher who cooperated on this practicum implementation. The results of this evaluation indicate that two of the five target students were unable to answer 80 per cent of the questions correctly (Appendix H).

Week Three:

Students were given the task of determining how waves are made. Through use of the scientific method, each group formed a hypothesis, gathered materials, described the procedure, completed the experiment and wrote observations and results. The group members were held responsible for the success of everyone on the team. Each student was required to complete the evaluation form (Appendix G). The target group showed moderate gains in their understanding of the purpose and observational skills (Appendix H).

After employing the scientific method of investigation to two projects, the students were asked to take a test to determine their mastery of the nomenclature employed in the scientific method of investigation (Appendix I). Each student expressed a desire to be tested in English only. Even during work

in class, the English scientific terms were used by the bilingual students because they were unfamiliar with Spanish translations of the terms. The results of this evaluation are documented in Appendix J.

Week Four:

A comparison of temperatures found in most of the ocean waters with those that are shallow and costal was made through measuring temperatures and feeling the water in two bowls, one at 65 degrees Fahrenheit and one at 36 degrees Fahrenheit. Once again, verbal communication among group members, both in English and in Spanish, enabled the students to understand the concept. A song was learned that described the ocean waters and named the oceans.

Week Five:

At this midpoint of implementation, the teacher implementing this practicum analyzed the records of progress and felt that progress was being made in the interaction of groups. Students were becoming more familiar with the scientific method of questioning and experimenting. It was, however, sensed that the size of the groups needed to vary occasionally. Therefore, some teaming of twos and threes took the place of the five-

to six-member groups for some activities. Always, a bilingual student was teamed with a student with limited English proficiency.

Maps and globes were used to observe, locate, and compare oceans of the world. Students were asked to locate oceans on maps as an independent activity following teacher direction on the large wall map. Teams of three students covered globes with colored paper to indicate blue for water and brown for land. Amount of blue and brown paper was contrasted.

A pie graph comparing the sizes of the oceans was completed by each student, working in teams of two. The teacher interviewed each target student to ascertain understanding of graph. In each case, the student was able to explain the relative size of the oceans.

Week Six:

Students appeared to enjoy acting out a poem about the ocean's depths and making an ocean flip-up that acquainted the students with bioluminescent creatures in the ocean. Each of the original groups rehearsed the poem and competed for best presentation. The flip-up helped children perceive some of the life in the depths of the sea. The target group recited the poem to a group

of fifth graders who were in a self-contained ESOL class. This was a highlight of the study for this second grade group. Their self-esteem surged ahead with that performance.

Week Seven:

The teacher guided students to understand that all animals in the ocean depend upon other living things for food. Original group members worked together to make a paper chain with pictures of marine organisms, showing how these organisms depend on one another for food. Target students were required to explain the food chain to the teacher who is writing this proposal. In each case, the target students were able to explain the concept of a food chain in broken, but understandable, English. Magazine pictures were cut out to make a collage of foods from the ocean that humans consume.

Week Eight:

Pairs of students made posters showing ways that beaches may be kept clean to protect the ocean. Each pair formulated ideas and expressed them in pictures to show a contrast between environmental pollution and protection. Informal interviews with target students checked the understanding of the concepts and the

vocabulary.

Week Nine:

The teacher gave guidelines for review of all concepts introduced. Team members discussed items as a group. Students practiced answering all questions on the posttest (Appendix K) as a group.

Week Ten:

At the conclusion of the ten week implementation period, the teacher who is writing this practicum administered the posttest (Appendix K). Results were recorded and compared to the pretests given at the beginning of the implementation (Appendix L).

A self-esteem questionnaire (Appendix E) was administered. Comparisons of attitudes of the students were noted (Appendix F). Although no great change was noted on the student responses, the teacher observed students engaging in classroom activities more enthusiastically as the implementation progressed.

Varying degrees of improvement in scientific knowledge and skills were demonstrated by the target group and are discussed in the results of the practicum.

The results of this practicum project were discussed with the principal. The principal reviewed the projects

and the evaluation results. This project received a positive commendation and a request that similar projects be used in the future.

CHAPTER IV

Results

The teacher implementing this practicum noted behavioral changes that can only be described by observation. Participation by the target group became a critical part of every lesson. The target group of students became more willing to accept the help of other students and less reluctant to ask the teacher for help when the language became a barrier for them. Up to this point in the school year, the target group often sat without making an effort to participate in the science lessons. When they perceived themselves to be an important part of a group, they seemed to rise to meet the occasion and make real and valuable contributions to the class.

The students, whether English-speaking, Spanish-speaking, or bilingual began to demonstrate an understanding of some of the problems facing the child who is unable to function in the major language of the classroom. As a result of this sensitivity, it was noticed that throughout the school day, greater attention was paid to the needs of the students with limited English proficiency. Although this practicum

concentrated on the science lessons, there was carry over into all other classes. The students with limited English proficiency also became more open with the teacher. The target students took more risks with the English language. They also knew that they could have dependable friends to act as interpreters when needed.

Although self-esteem questionnaires indicated positive self concepts from the beginning of the study, it is felt by the teacher, that their actual attitudes toward school have improved during this ten-week implementation time. Appendix F shows changes in attitudes as indicated by the target students. In two cases, the students indicated that they no longer were nervous when the teacher asked a question. One student indicated a change in attitude about his ability to do things.

The understandings demonstrated at the conclusion of the first science fair project exceeded those expected by the writer of this practicum. The knowledge gained in the cooperative learning groups was evident (Appendix H). It was necessary for each student to answer the questions in Spanish, so the help of a Spanish-speaking teacher was enlisted. The students responses were

recorded as "excellent, good, average, poor, or failing." The student with the poorest scores subsequently withdrew from the school and transferred to another school out of the district. This was a disappointment, because this child would have posed a greater challenge.

Seventy-five percent of the target students completing the second evaluation form gained in overall scores. The anticipated 50 percent improvement in responses was not realized. Approximately 38 percent of the responses were improved by the second evaluation.

Each cooperative learning group prepared a science fair exhibit board to be entered in the science fair at the target school. Prior to the preparation of the first board, a test to identify the steps used in the scientific method of discovery was administered (Appendix I). At the conclusion of the science fair, when each group had completed their boards and had them judged, a follow-up testing was repeated using the example in Appendix I. An analysis of these test results for the students in the target group indicates tremendous gains in the understanding of terminology used in the scientific method of investigation (Appendix J). The students took pride in the science fair exhibits. Each

of the target students brought their parents to the science fair in the evening and enthusiastically explained the projects to their parents, who seemed equally pleased.

A pretest of science concepts and vocabulary appropriate to second grade was given at the beginning of the ten-week implementation period (Appendix K). An appraisal shows that no student made a passing score on the pretest (Appendix L).

Students in the target group enjoyed the activities planned for this study. They were enthusiastic about the activities employed in the lessons. They enjoyed interacting with their peers in a learning situation. By experiencing the feel of the water as it would be near shore in warmer climates and comparing that to the feel of the majority of the ocean waters of the world, they used their sense of touch in a memorable way. With their peers helping to express the ideas in understandable language, real learning took place. By making paper chains that hooked together to show the food chain of specific ocean animals, students could manipulate materials and develop mental pictures of how the puzzle fits together.

Singing and chanting were activities that helped the target students increase their speaking and reading vocabulary in a non-threatening way. After much practice, the target students were allowed to perform their songs and chants in front of a self-contained fifth grade class who also had limited English proficiency. Both classes were thrilled with the opportunity to share in the new language achievements.

Globes were used to allow students to trace a path around the Earth by water and to attempt the same feat by land. The land masses were compared with the water by covering the land masses with small squares of brown paper and the water with small squares of blue paper. By noting the number of small squares required in each color, a vivid comparison of water and land was made. Graphs offered a picture of the relative sizes of the oceans and was able to help students make comparisons.

An on-going environmental awareness program was integrated into the study of science by showing ways that our beaches may be kept clean. Students worked in teams to make posters to suggest ways that they could contribute to the preservation of the environment.

All activities were met with enthusiasm. Children

began bringing in books with pictures or articles that related to the study. The classroom had a library of magazines related to nature. An increase in the circulation of these magazines was noted.

At the conclusion of the ten-week implementation period, students were given the posttest (Appendix K). All of the target students made scores of 93 percent or 100 percent correct responses on this test.

It is felt that the use of cooperative learning techniques, coupled with a variety of activities enlisting the use of several senses, contributed greatly to the success of this study. The students seemed to really enjoy most of the activities and thought of science as a "fun" time of the day. By pairing bilingual, English-only speaking, and those with limited English proficiency, it is felt that more learning took place. It takes a good understanding of a concept to be able to interpret it for others, which these students were able to do.

If cooperative learning techniques were used throughout the entire school to teach science, this teacher feels that standardized test scores could be elevated. The teacher writing this practicum also

realizes the need for more active involvement on the part of the students in the procedure.

CHAPTER V

Recommendations

The program developed in this practicum can be used to enhance the science program for students with limited English proficiency at any grade level. The success met by the target group demonstrates the advantages of using cooperative learning techniques. By organizing the program to include a variety of activities whereby different senses are actively engaged, interest levels may be kept high.

Stanford Achievement Test scores were low in the target school. Students who experience science, rather than merely read science, are the ones who develop a greater understanding of the subject. By solving problems according to the scientific method of investigation, it is felt that thinking skills can be enhanced, organizational techniques can be put into play, and students will be able to realize that experimentation may be used to discover answers to questions instead of merely accepting theory.

Peers working together in cooperative groups have helped the students with limited English proficiency to understand the subject matter and to realize a sense of

rapport within the classroom. Therefore, it is the intent of the writer of this practicum to organize the content areas (social studies, health and safety, literature and expressive language, and science) into integrated programs and use cooperative learning techniques to execute the objectives of the program during the next school year.

Because of the high ESOL enrollment in the target school, it is felt that there will be a great need to concentrate efforts to meet the needs of those students with limited English proficiency in the classroom, not just in the special pull-out classes. The writer of this practicum intends to discuss this program with the other primary teachers within the target school. A copy of this practicum will be available for possible implementation at other grade levels.

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Appendices

Appendix A
Stanford Achievement Test Scores
In Science

STANFORD ACHIEVEMENT TEST SCORES
IN SCIENCE
Administered April, 1989

Median Percentile by Grades

Grade	Percentile
3	57
4	48
5	51
6	53

Appendix B

Questions Related to Science Book Illustrations

QUESTIONS RELATED TO PICTURES

Journeys in Science Page 42

1. Look at picture number one. What is happening in this picture? Which word at the bottom of the page goes with this picture?

2. What kind of weather is shown in picture number two? Find the word at the bottom of the page that tells what is coming from the cloud.

3. Look at picture number three. What season of the year would we find children making a snowman?

4. What are the white things in the sky in picture number four?

5. This is a picture that we might see on television. It is taken from a satellite. What kind of storm is this?

Appendix C

Questions Related to Science Activities

Example of Science Activity Discussion Questions

An experiment was done in the class using a demonstration method. English was the only language spoken during the experiment.

This investigation involved evaporation of salty ocean water to answer the question, "What happens to the salt when the water evaporates?"

Students had various hypotheses. The class watched for several days and noted the changes that were taking place.

At the end of four days, the water was all gone and only salt crystals remained. The students enjoyed looking at these through a microscope.

When the five students with limited English proficiency were asked, "Why did we do this experiment?" no one was able to answer.

When these same students were asked how the experiment was done, no one was able to answer correctly.

Three students were able to tell the writer that the water was there, but it is gone now.

No student could express in English what was discovered by doing this experiment.

It is felt that the students had ideas, but were unable to verbalize them.

Appendix D

Science Test for Chapter One

Name _____ 49 Score _____
100 points possible

17 Unit 1 Test

Use after page 43.

Circle *yes* or *no.* *(4 points each; recalling)*

1. Wind is moving air. Yes No

2. Temperature is measured by a weather vane. Yes No

3. All clouds have the same shape. Yes No

4. Snowflakes are ice crystals that fall to the ground. Yes No

5. A breeze is a fast wind. Yes No

6. Tornadoes look like funnel-shaped clouds. Yes No

7. Weather can change every day. Yes No

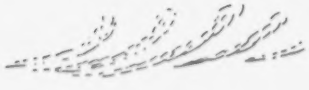
8. Hurricanes are formed over the ocean. Yes No

Draw a line from the cloud to the words that describe it. *(8 points each; observing, recalling)*

9. These are fluffy, white clouds. They usually mean fair weather.

10. These are dark clouds that are close to the earth. They usually mean a storm is coming.

11. These clouds look like feathers. They are very high and mean the weather will change.



Laidlaw Educational Publishers
Journeys in Science/2

17 Unit 1 Test

Put an *X* in front of each phrase that tells something that is unsafe to do during a thunderstorm. ***(3 points each; recalling, verifying)***

___ **12.** Stand under a tree in an open area.

___ **13.** Stay away from open windows.

___ **14.** Talk on the telephone.

___ **15.** Stay in your car.

___ **16.** Ride your bicycle.

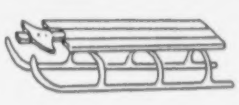
___ **17.** Go indoors.

___ **18.** Swim in a pool.

___ **19.** Use a hair dryer.

Put an *X* on the picture that shows something that does not belong with the season in most of the United States and Canada. ***(5 points each; comparing, analyzing, classifying)***

20. Winter



21. Spring

22. Summer

23. Fall

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Journeys in Science/2

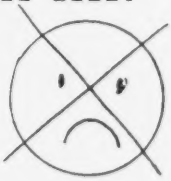
Appendix E

Self-Esteem Questionnaire

Self-Esteem Questionnaire

Example: Quiero a mi Mama. I love my mother.

Example: Me gusta el dolor de oido. I like earaches.

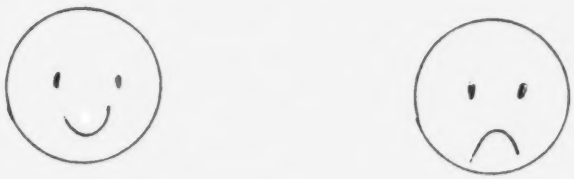


1. Estoy contento con migo mismo. I am happy with myself.

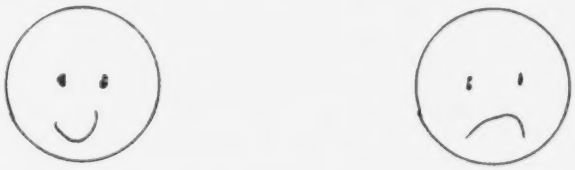
2. Soy feliz en mi hogar. I am happy at home.

3. Me gusta la escuela. I like school.

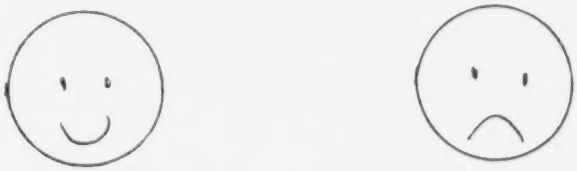
4. Le agrado a mi maestra. My teacher likes me.



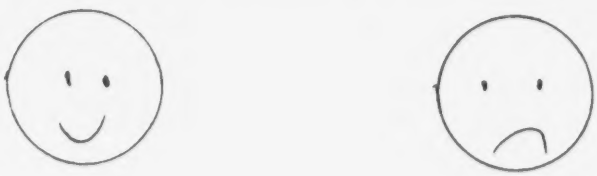
5. Me pongo nerviosa cuando mi maestra me hace una pregunta. I am nervous when my teacher asks me a question.



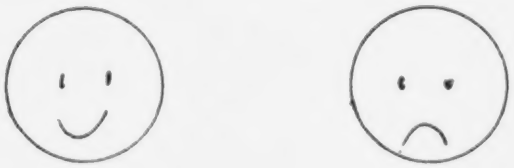
6. Puedo hacer muchas cosas bien. I can do many things well.



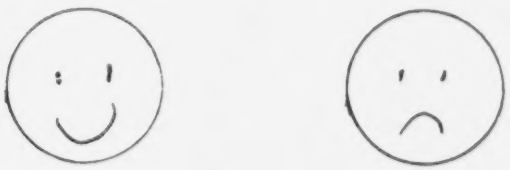
7. Le agrado a mis amigos. My friends like me.



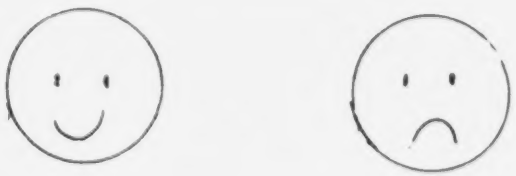
8. Me gusta hablar español. I like to speak Spanish.



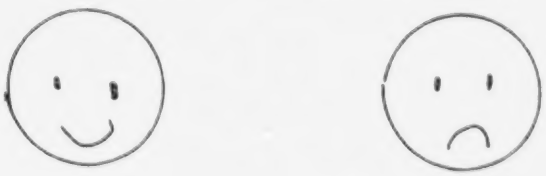
9. Me gusta hablar inglés. I like to speak English.



10. Me gusta leer. I like to read.



11. Me gusta la ciencia. I like science.



Appendix F

Record of Change in Self Esteem

RECORD OF CHANGE IN SELF ESTEEM

Questionnaire administered during Week One:

Pupil	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11
1.	+	+	+	+	+	+	+	+	+	+	+
2.	+	+	+	+	–	+	+	+	+	+	+
3.	+	+	+	+	–	–	+	+	+	+	+
4.	+	+	+	+	+	+	+	–	+	+	+
5.	+	+	+	+	–	+	+	+	+	+	+

Questionnaire administered during Week Ten:

Pupil	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11
1.	+	+	+	+	+	+	+	+	+	+	+
2.	+	+	+	+	+	+	+	+	+	+	+
3.	+	+	+	+	+	+	+	+	+	+	+
4.	+	+	+	+	+	+	+	–	+	+	+
5.	N/A	(withdrawn)									

Note: Q = Question Number

\+ = Positive Response

– = Negative Response

Appendix G

Evaluation of Science Fair Project

EVALUATION OF SCIENCE FAIR PROJECT

1) What question were you trying to answer?

2) How did you do this experiment (or survey)?

3) What did you see, hear, feel or smell when you did the experiment?

4) What did you discover when you did the experiment (or survey)?

Appendix H

Comparison of Responses on the Evaluation of Science Fair Projects

Responses to Science Fair Project Number One

Student	Q1	Q2	Q3	Q4
1.	Good	Excellent	Good	Failing
2.	Good	Excellent	Good	Excellent
3.	Excellent	Good	Average	Good
4.	Good	Excellent	Average	Excellent
5.	Failing	Average	Failing	Failing

Q = Question number (reference Appendix G)

Responses to Science Fair Project Number Two

Student	Q1	Q2	Q3	Q4
1.	Excellent	Good	Excellent	Good
2.	Good	Excellent	Good	Excellent
3.	Excellent	Excellent	Good	Good
4.	Good	Excellent	Good	Excellent
5.	N/A Withdrew			

Q = Question number (reference Appendix G)

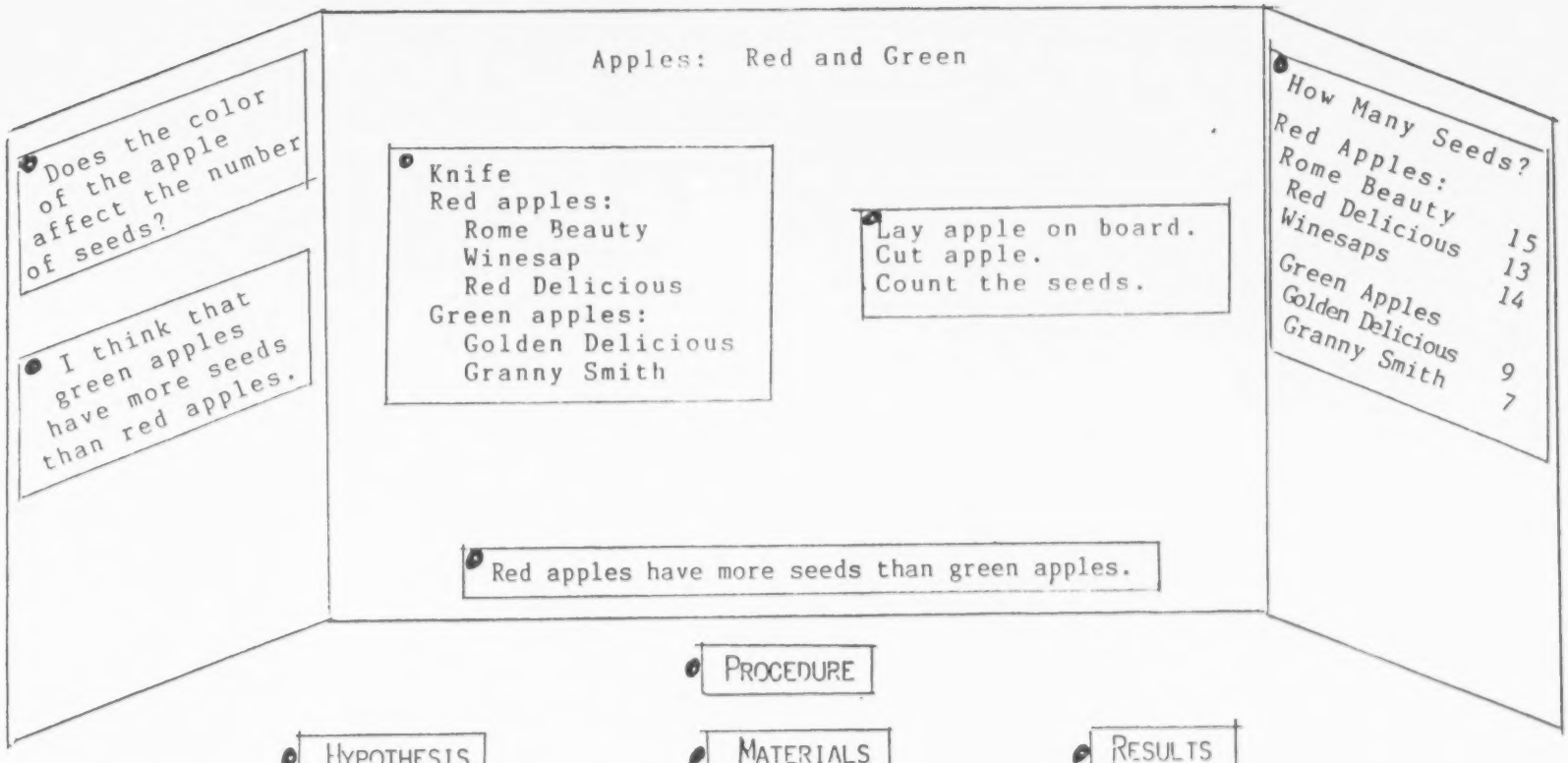
Appendix I

Steps Used in the Scientific Method

MATCH THE DOTS TO LABEL THE BOARD.

PROBLEM STATEMENT

OBSERVATION



PROCEDURE

HYPOTHESIS

MATERIALS

RESULTS

63

Appendix J

Analysis of Test Results

Steps Used in Scientific Method

Analysis of Test Results

Steps Used in Scientific Method

Could Student Number One match the terminology used during scientific investigation with an example of the term?

Term	Pretest	Posttest
Problem Statement	No	Yes
Hypothesis	No	Yes
Materials	No	Yes
Procedure	No	Yes
Observation	No	Yes
Results	No	Yes

Analysis of Test Results

Steps Used in Scientific Method

Could Student Number Two match the terminology used during scientific investigation with an example of the term?

Term	Pretest	Posttest
Problem Statement	No	Yes
Hypothesis	No	Yes
Materials	No	Yes
Procedure	No	Yes
Observation	No	Yes
Results	No	Yes

Analysis of Test Results

Steps Used in Scientific Method

Could Student Number Three match the terminology used during scientific investigation with an example of the term?

Term	Pretest	Posttest
Problem Statement	No	Yes
Hypothesis	No	Yes
Materials	No	Yes
Procedure	No	Yes
Observation	No	Yes
Results	No	Yes

Analysis of Test Results

Steps Used in Scientific Method

Could Student Number Four match the terminology used during scientific investigation with an example of the term?

Term	Pretest	Posttest
Problem Statement	Yes	Yes
Hypothesis	Yes	Yes
Materials	No	Yes
Procedure	No	Yes
Observation	No	Yes
Results	No	Yes

Appendix K

Pre- and Posttests

Science Test

Name:_____Date:_____

Draw a line under the correct word:

1. Most of the water in the oceans is (hot, cold).

2. Ocean water tastes (salty, sweet).

3. Deep in the sea it is (light, dark).

4. Do any animals live deep in the sea?

   (Yes No)

5. If you dived deep into the ocean, the water would be (colder, warmer).

6. Where do most fish live? (In deep water, in shallow water)

7. Can there be an earthquake under the ocean? (Yes No)

8. Can there be a mountain under the water?

_____

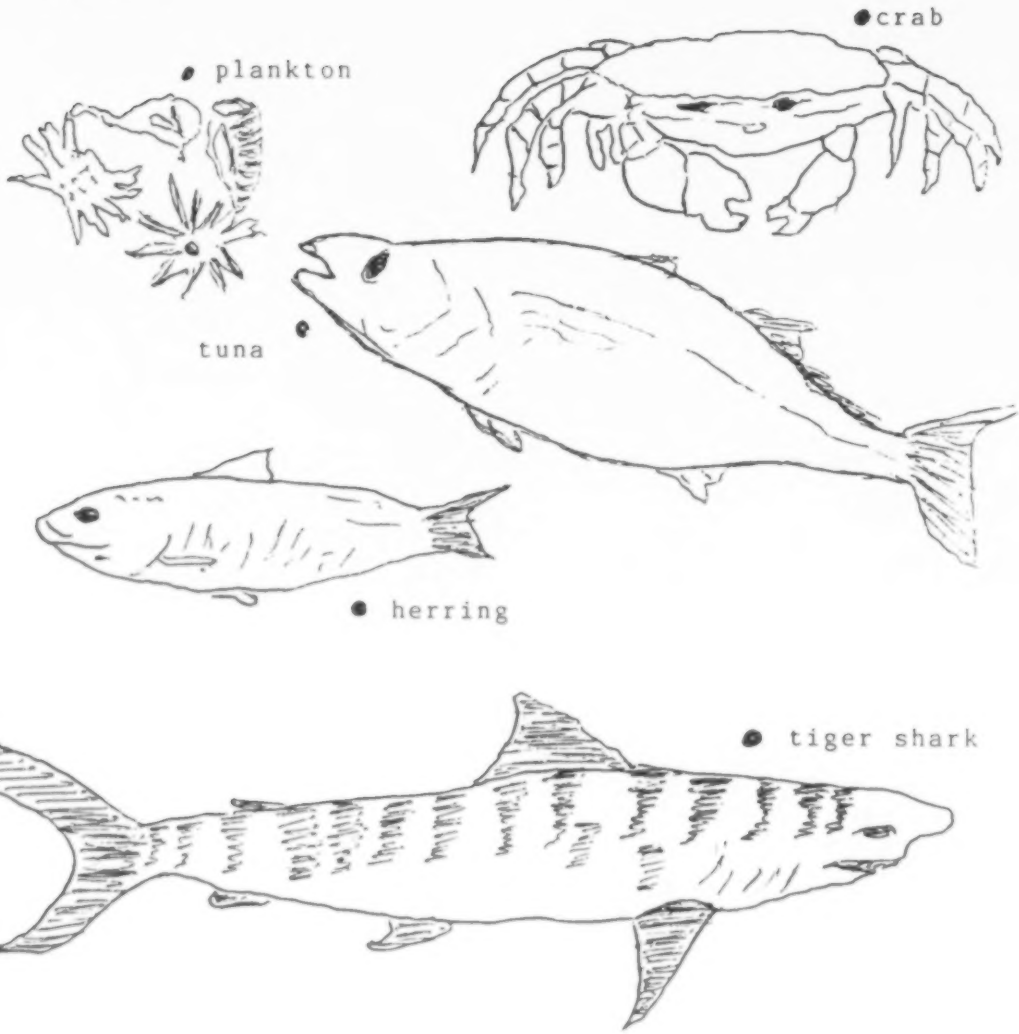
9. What causes waves?

_____

_____

10. Draw a picture to show how YOU can help keep our beaches clean.

11. Connect the dots to show a food chain for sea animals.



Appendix L

Difference in Pre- and Posttests

PRE- AND POSTTEST SCORES

Name	Pretest	Posttest	Difference
1.	13%	93%	80%
2.	33%	100%	67%
3.	20%	93%	73%
4.	33%	93%	60%
5. *	N/A	N/A	N/A

#5 withdrew during second week of implementation